

### REMARKS

Reconsideration of the above-identified application in view of the amendments above and the remarks following is respectfully requested.

The office action of January 12, 2007 acted upon claims 1-23. Claims 1, 3-5, 11-16, and 18-21 were rejected under 35 USC, section 102 (b). Claims 2, 6-10, 17, and 22-23 were rejected under 35 USC, section 103 (a). By this response, claims 1-23 have been canceled without prejudice, and new claims 24-44 have been presented in the belief that they recite allowable subject matter.

### § 102(b) Rejections

The Examiner has rejected claims 1, 3-5, 11-16, and 18-21 under § 102(b) as being anticipated by E.S.T. Electrolysis System brochure (henceforth, "E.S.T. brochure"). The Examiner articulates that the brochure discloses the claimed method and apparatus for the removal of scale-forming compounds in water supply systems comprising an electrochemical cell having the structure claimed, the elastic scraper, and a control system. The Examiner's rejections are respectfully traversed.

In sharp contrast to the art disclosed by the E.S.T. brochure, in which the scraping mechanism is solely for removing scale from the tank wall, claim 1 recites that the scraper, in addition to being operative for scraping the wall of the tank, is associated with a control system designed and configured to activate

the scraper “so as to promote said scale deposition on the wall.” This limitation is not explicit, nor fairly suggested, by the E.S.T. brochure.

Similarly, independent claims 18 and 21 recite limitations pertaining to activating the scraper so as to promote scale deposition on the wall.

Independent claim 18 also recites a constant-current limitation. The E.S.T. device in the above-referenced brochure is a constant voltage device.

Thus, Applicant believes that the independent claims, as originally recited, are unanticipated by the cited prior art, and overcome the Examiner’s rejections on § 102(b) grounds.

### **§ 103 Rejections**

The Examiner has rejected claims 2, 6-10, 17, and 22-23 under § 103(a) as being unpatentable over the above-referenced brochure and further in view of U.S. Patent No. 3,951,161 to Rohrback et al. (henceforth, “Rohrback”). The Examiner notes that Rohrback is cited to show that it is known in the art to measure the resistance and/or thickness and to derive appropriate treatment based upon the measurement. The Examiner’s rejections are respectfully traversed.

Applicant readily concedes that it is known in the art to measure the resistance and/or thickness of a layer of scale, and to act upon the layer based upon the measurement. The teachings of Rohrback are indeed typical of such art. Rohrback explicitly teaches that as soon as scaling is detected,

a suitable change is made in order to prevent continuance of substantial precipitation of adherent scale or other undesired

substance. This change frequently comprises, for example, the addition of scale-inhibiting compounds (such as sodium hexametaphosphate or an organic phosphonate when the liquid is aqueous, and such as sulfonic acid, naphthenic acid or an oil-soluble detergent-type substance when the liquid is petroleum or a petroleum product) to the liquid 11. Other changes, some of which are discussed below, include changes of pH, changes in the flow velocities in the system, or changes in other process variables.  
(column 9, lines 11-23)

However, in sharp contrast to the teachings of Rohrback, in which scale inhibition is the objective, Claim 1 recites an electrochemical device having an elastic scraper disposed within a tank, the scraper operative for scraping the wall of the tank, and a control system designed and configured to activate the scraper "so as to promote said scale deposition on the wall."

The E.S.T. brochure and Rohrback might be combinable to obtain a system in which simple mechanical scale removal is timed according to the increased resistance of a growing layer of scale, the timing being performed according to established engineering/operating practice.

In typical operation of the E.S.T. technology, when the thickness of the precipitated salts reaches about 0.3 – 0.5 cm, the electrical resistance reaches unacceptably high values and scale cleaning is necessary. This point is elucidated in the instant Specification:

Until recently, the known function of scraper 22 was to periodically remove scale 24 from the inner wall 20 of tank 12, so as to prevent an excessive build-up of scale. In my co-pending, unpublished (and as such, is not to be construed as prior art with regard to the present application) Israeli Patent Application Serial No. 151,181, which is incorporated by reference for all purposes as if fully set forth herein, it is

taught that when the thickness of the precipitated salts reaches about 0.3 - 0.5 cm, the electrical resistance reaches unacceptably high values and scale cleaning is necessary.  
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The thickness of the scale that causes unacceptably high electrical resistance is about 0.3 - 0.5 cm. It is sometimes practical to operate the apparatus until the thickness of the precipitated salts reaches as much as about 2 cm.

Thus, the teachings of Rohrback or the like might be applied to measure the resistance of the scale layer, and to act upon the layer, i.e., to scrape the tank wall, upon measuring such an unacceptably high electrical resistance.

Surprisingly, however,

it has been discovered by the inventor that careful monitoring and control of the scraping operation for removing scale 24 from wall 20 (the cathode of the electrochemical cell) of tank 12 greatly increase the rate of scale deposition on the surface of the wall, such that the level of unprecipitated scale in the water being processed is appreciably reduced.  
(page 12)

This phenomenon is not taught, nor fairly suggested by the combined teachings of the cited prior art. Moreover, various engineering considerations known to those skilled in the art teach away from frequent scraping of the wall. These include:

- wear/tearing of scraper/scraping mechanism;
- the scraping operation is associated with a washing cycle to remove the scale from the treated water. Frequent scraping means frequent washing, resulting in:

- (1) a significantly increased volume of waste effluent containing the scale particles, and
- (2) a decrease in the volume of the product -- treated water.

The instant Specification teaches that when the monitoring and control is performed based on scale thickness, the triggering thickness is preferably up to 800 microns, about 1/5 of the triggering thickness taught by the most closely related prior art, as disclosed in Israeli Patent Application Serial No. 151,181 to Elgressy. More preferably, the triggering thickness is up to 0.5 mm or 500 microns (page 5, lines 4-6), which is, at most, 1/6 to 1/10 of the triggering thickness taught by that most closely related prior art, and is as little as 1/40 of the thickness typically developed by prior-art E.S.T. units operated in the field.

Surprisingly-superior scale removal is achieved by the device and method of the present invention, as is explicitly disclosed in the instant Specification, inter alia, Table 1 (page 11) and the associated text, including page 15, line 14 – page 16, line 3.

While continuing to traverse the Examiner's rejections, the Applicant has, in order to expedite the prosecution, chosen to compose new independent claims 24 - 44 in order to clarify and emphasize the crucial distinctions between the device of the present invention and the teachings of the prior art cited by the Examiner. Specifically, independent claims 24, 37 and 39 have been composed so as to clarify that the control system includes at least one parameter for triggering the scraper to scrape said wall, wherein the parameter



is associated with a thickness of the scale deposition, the thickness reaching up to a maximum thickness of 800 microns.

In addition, new independent claim 37 and dependent claim 31 further recites a constant-current limitation. As articulated hereinabove, the E.S.T. device as disclosed in the above-referenced brochure is not a constant current device.

New dependent claims 33-35 and 42-44 recite limitations relating to control of the cell such that the calcium hardness in a water flow delivered to the cell is reduced and maintained at a level below about 110, 85, or 55 ppm, on a  $\text{CaCO}_3$  basis. By sharp contrast, the closest prior art, such as the device disclosed in the E.S.T. brochure, achieved a level of no less than about 170 ppm, on a  $\text{CaCO}_3$  basis, as disclosed in Table 1 and associated text of the instant Specification.

New dependent claims 32 and 41 recite limitations relating to a control system adapted to activate the scraper according to a combined function including both a physical property and a pre-determined time parameter. This combination is surprisingly efficacious, as disclosed in the instant Specification:

When the sole criterion for activating the scraper is electrical resistance, I have found that the rate of scale deposition often decreases with time. Without wishing to be bound by theory, I attribute this decrease to various surface effects on the crystalline scale surface, including sliming, which reduce the effective surface area of scale crystals that is available for enhancing additional scale deposition. Such surface effects appear to have little effect on electrical resistance.

Hence, by incorporating an additional criterion – that of maximum time elapsed between scrapings, the deleterious surface effects on the crystalline scale surface are curtailed, and the rate of scale deposition remains substantially constant over time.

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Neither the problem, nor the inventive solution embodied by the above-described limitation, is not explicit, nor fairly suggested, in the cited prior art.

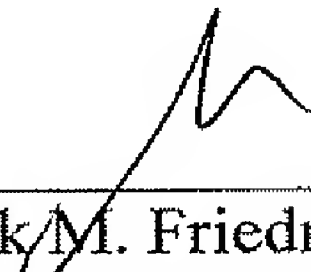
In summary, Applicant believes that the claims currently before the Examiner completely overcome the Examiner's rejections on § 102 and § 103 grounds.

#### New Claims

Support for new claims 24-44 can be found in the Specification. Specifically, independent claims 24, 37 and 40 draw support from original claims 1, 18 and 21, and from page 15, line 11. Claims 25-26, 27-32, 36, 38-39 and 41 draw support, inter alia, from original claims 6-7, 11-15, 17, 10, 19-20, and 17, respectively. New claims 33-35 and 42-44 draw support from Table 1 and the associated text in the instant Specification.

In view of the above amendments and remarks it is respectfully submitted that new claims 24-44 are in condition for allowance. Prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,



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